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**Inland Waters Directorate
Western and Northern Region**

**Direction générale des eaux intérieures
Région de l'ouest et du nord**



HISTORICAL FLOOD ANALYSIS

Ile à la Crosse

Buffalo Narrows

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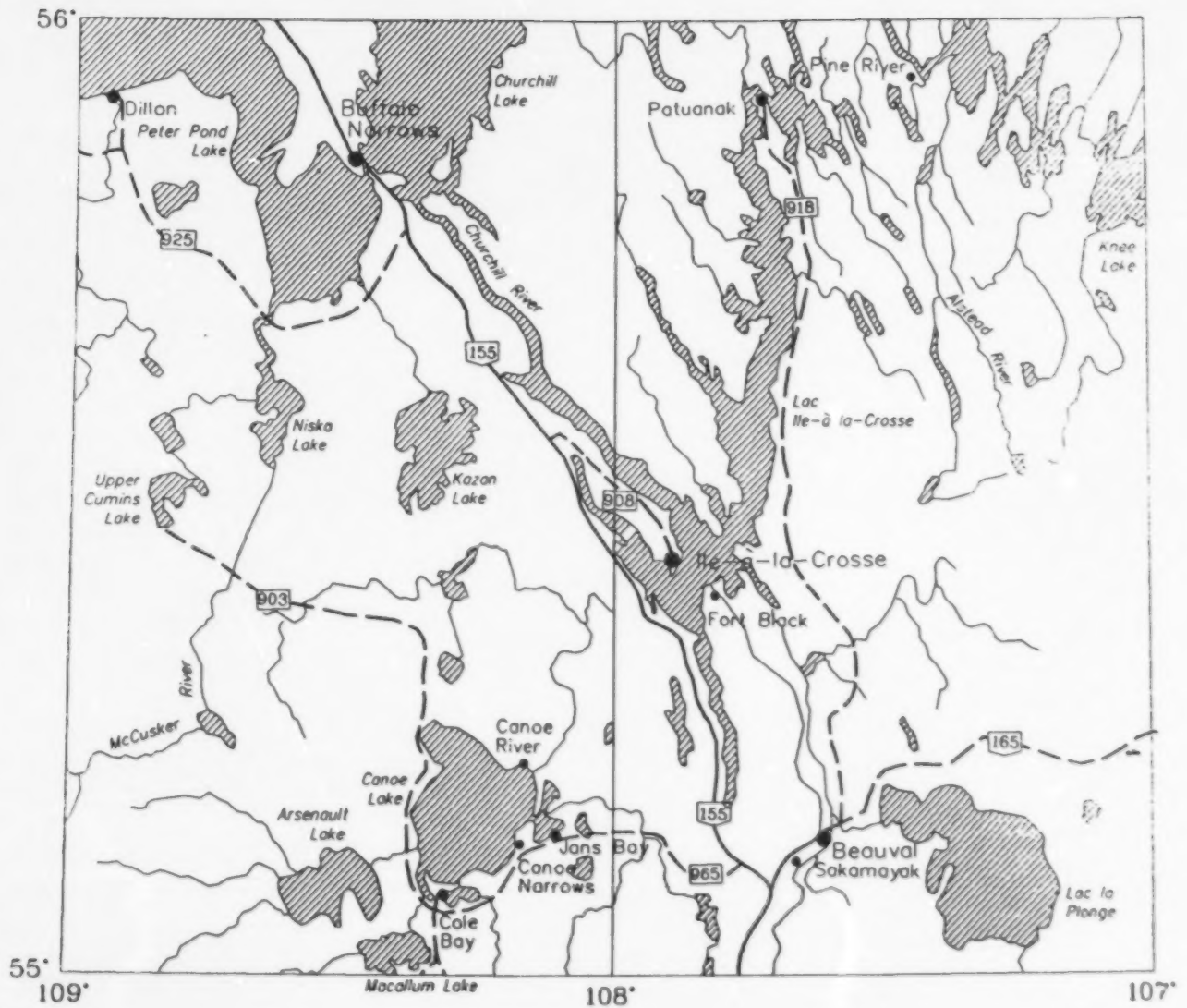
Introduction

On April 13, 1977 the governments of Canada and Saskatchewan signed a General Agreement Respecting Flood Damage Reduction and an Agreement Respecting Flood Hazard Mapping and Studies. The communities of Buffalo Narrows and Ile à la Crosse were included in Schedule A of the Mapping and Studies Agreement. The base mapping for the communities was completed prior to the expiry of the agreement on April 12, 1982, however the hydrotechnical reports were not completed. The new Mapping and Studies Agreement, signed on March 4, 1987, enabled the completion of the flood hazard mapping.

The main purpose of the agreement is to reduce potential flood damages by mapping flood potential and by designating the flood hazard areas. Upon designation, financial assistance by the senior governments would be limited to new development that is adequately floodproofed. New development that was not floodproofed would not qualify for disaster assistance payments. Local governments would also be encouraged to recognize the flood hazard in zoning bylaws and development plans.

This report documents the method used to check the accuracy of the base maps for the community of Ile à la Crosse. Also the rationale used to determine the historical flood levels for Lac Ile à la Crosse and Churchill Lake at Buffalo Narrows, as well as the relationship between the two lakes.

Figure 1



Section One: Base Map Accuracy

A final survey report, that included the location and elevation of the benchmarks and control points used to produce the 1:2000 base maps, was either not prepared or was misplaced as it could not be located. Without this report, the accuracy of the base maps are open to question.

Chronology of Survey Activities at Ile à la Crosse:

1. November 1980: Vertical control mapping conducted by McElhanney Surveying and Engineering, Ltd. from benchmark 80V023 (Saskatchewan provisional first order circuit along Hwy 155) to the community of Ile à la Crosse.
2. September 1988: Benchmark S88-708, located behind the Saskatchewan Department of Parks and Renewable Resources office building in Ile à la Crosse, was installed by Water Resources Branch, Environment Canada.
3. December 1988: First order level circuit from benchmark 80V023 to benchmark S88-708, located in Ile à la Crosse. Surveys completed by Peter Surveys, Ltd. ¹

¹ Analysis of Field Data - Ile à la Crosse Levels Project - Peter Surveys Ltd.

4. October 27, 1989: Level circuits from benchmark S88-708 to top of fire hydrant at the southwest corner of the intersection of Lavoie Street and Peter Crescent were completed by Environment Canada. The elevation of the hydrant was 422.480 m.

The original level notes were reduced using elevations of the vertical control points listed on the base maps to determine the elevation of the fire hydrant. From the level notes the hydrant was located on Lavoie Street and closer to vertical control point (VP) #36 than VP #35. The elevation of BM #1 (fire hydrant) is ± 422.620 m (Appendix A).

The difference of 0.140 m between the elevation determined by using the vertical point elevation on the base maps and the level circuit of October 27, 1989 indicates that the accuracy of the base maps is acceptable for the Canada-Saskatchewan Flood Damage Reduction Program.

Figure 2



Section Two: Historical Flood Level - Lac Ile à la Crosse

Ile à la Crosse is an old settlement that was established in 1805 as a mission and fur trading center. The community has a history of flooding and a review of historical records indicated that the flood level in 1902 was the highest on record.

Lake elevations were recorded for the period 1932 to 1955 at hydrometric station 06BB001-Lac Ile à la Crosse at Ile à la Crosse. The record of once a week manual readings were used by Churchill River Power Co. to forecast flows on the Churchill River for the Island Falls Generating Station. The quality of the record is considered poor to fair. Due to the poor quality of the record and because the lake level data could not be tied to current GSC datum, a hydrological analysis could not be conducted that met FDRP technical specifications. However, from a review of the records and related correspondence lake levels during the 1932 to 1955 period were not as high as the 1902 level nor the levels experienced in the early 1920's. The historical high water level used for Lac Ile à la Crosse is reasonably accurate based on description of the flood in relation to the church and meets the Flood Damage Reduction Program's objective of mapping known flood hazard areas.

The existing church on Lajeunesse Avenue is located on the same site as the church in 1902. This was verified from a review of a village survey plan, dated 28 February 1922, and from conversations with local residents.

Based on this information and examination of the 1:2000 scale base maps, the flood level in 1902 was estimated at 422.3 m. Lake levels that high separate the community into several islands, a condition stated in A.R. McDougall's letter, dated March 5, 1930, "During high water, the village, which is built on a long narrow point, is cut into a series of small islands. In 1902 the water came into the church (a few inches above floor level) and during the year 1920-21 and 22 the water was almost as high." (Appendix C).

Section Three: Relationship between Churchill Lake and Lac Ile à la Crosse

Table No. 1 compares staff gauge readings taken on the same days on Lac Ile à la Crosse and Churchill Lake. The elevations are referenced to GSC datum determined from benchmarks established by a first order provisional vertical control survey conducted by the Surveys Branch, Department of Highways. A review of the elevations indicate that at low-medium stage the lakes could be considered the same. The minor differences in the manual readings can be attributed to wind action.

Table No. 1

DATE	CHURCHILL LAKE AT BUFFALO NARROWS	LAC ILE À LA CROSSE AT ILE À LA CROSSE	DIFFERENCE
Sept. 19/88	419.571 m	419.564 m	+0.012 m
Feb. 27/89	419.432 m	419.474 m	-0.042 m
Oct. 26/89	419.474 m	419.500 m	-0.026 m

In order to establish a relationship between the lakes at high stage, the 1974 elevations recorded for Churchill Lake and Lac Ile à la Crosse by Saskatchewan Environment were compared (Figure 3). Although the 1974 records are not to a common datum, the differences in the range in stage were used to approximate the hydraulic conditions. The conditions will vary each year depending on the initial lake levels and the flows in the

contributing rivers. At higher stages, similar to 1902, the head loss between the two lakes was assumed to be at least as large as 1974.

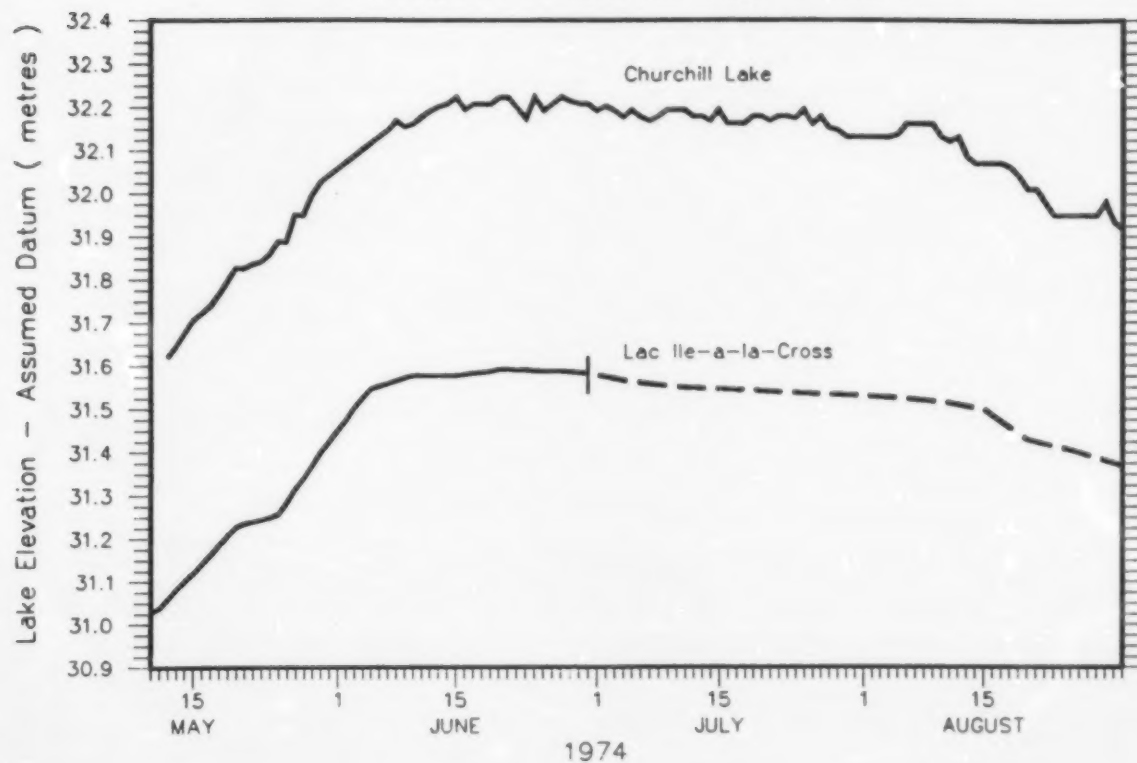
The change in stage on Churchill Lake for the period May 10 to June 20, 1974 was 0.64 m (2.1 ft). For the same period the range in stage on Lac Ile à la Crosse was 0.49 m (1.6 ft). Based on these elevations the head loss established between the lakes was 0.15 m (0.5 ft). This difference was maintained for approximately six weeks until the lakes began to recede.

The water levels recorded at the hydrometric station, Churchill River near Patunak, had a range in stage of 0.40 m (1.3 ft). This is consistent with the stage changes recorded on the lakes as the gauge for the hydrometric station is located partially into the Shagwenaw Rapids at the outlet of Lac Ile à la Crosse.

As the 1902 water levels were higher than in 1974 the head loss was assumed to also be higher. The head loss estimated for 1902 was 0.2 metres. For 1902 a level of 422.5 m (1902 peak at Ile à la Crosse of 422.3 plus 0.2 m estimated high lake level head difference between Churchill Lake and Lac Ile à la Crosse) is recommended for the daily maximum elevation for Churchill Lake.

Figure 3

Hydrograph of Observed Water Elevations



- Records obtained by Saskatchewan Environment.
- Lake elevations based on different assumed datums.
- Graph use to compare range in stage only.

Conclusions:

1. The accuracy of the 1980 base maps prepared by McElhanney Surveying and Engineering are acceptable to determine the flood lines for the community of Ile à la Crosse.
2. The 1902 historic lake elevation for Lac Ile à la Crosse is estimated to be 422.3 m.
3. The 1902 historic lake elevation for Churchill Lake is estimated to be 422.5 m.

APPENDIX A

CHECK OF BASE MAPPING ACCURACY

Page 18 of original level notes:

JOB NO. <u>270466</u> (2)					
DATE <u>18/NOV/80</u> PAGE <u>18</u>					
STA	BS	IFS	FS	ELEV.	
VP-35	2.217		2.530		-0.048
TP	2.215		1.488		(
T.P	1.149		1.491		
FIRE HYD. BM #1	0.048		1.006		+1.596
VP-36	2.429		1.951		
TP	1.852		1.780		
TP	3.460		0.960		(
TH #16			0.572		+4.428

From 1:2000 scale maps

V35 elev. 421.06 m

V36 elev. 420.68 m

Starting from V35

STA	BS	IFS	FS	ELEV.
VP35	2.217	423.277		421.06
TP	2.215	424.004	1.488	421.789
TP	1.149	423.662	1.491	422.513
Fire Hyd. BM #1			1.006	<u>422.656</u>

Starting from V36

VP36	1.951	422.631		420.68
Fire Hyd. BM#1			0.048	<u>422.583</u>

As VP35 and VP36 have been adjusted the elev. of BM #1 (Fire Hydrant) is $\pm$ 422.620 m.

The hydrant is assumed to be located on Lavoie Street.

TYPED FROM ORIGINAL

APPENDIX B

August 19th, 1954.

Mr. J. F. Hellish, District Engineer,
Department of Public Works,
Harbours & Rivers Engineering Branch,
District Engineers Office,
806 Confederation Bldg.,
457 Main St.,
Winnipeg 2, Manitoba

Dear Mr. Hellish:

Please refer to your letter of August 2nd, 1954 -
re Ile a la Crosse.

In January 1930, we established a gauge at the mouth of
the Beaver River on Ile a la Crosse, based on the elevation of
Ile a la Crosse at that time assumed to be 100.00. With this datum,
we set the gauge at 103.96.

Since that time, our records show a variation of 4.53 ft.
with the high in 1932 of 102.83 and a low of 98.30 in 1952. The
lows are in the winter months, although we have a recorded low of
98.53 in open water.

According to our history, based on information of the
Ile a la Crosse Priest given in 1930, the water of Ile a la Crosse
was a few inches above the Church floor in 1902 and the floor of the
Church is at elevation 109.00 or 6.17 feet above our peak of 1932.

I enclose a tabulation of maximum, minimum and average
lake elevations since our records began in August, 1930. We get the
readings from our Mr. Richard Kirby at the end of each month, and
our last reading of 101.71 was July 29th, 1954.

We hope the above will give you useful data, and if you
require more, we will be pleased to furnish whatever we can.

Yours truly,

R. W. DAVIS
Superintendent

RVD/il
Enc.1.

Island Falls, Sask.

March 5th. 1930.

ISLE A LA CROSSE STORAGE DAM.

Following instructions to make an investigation of storage possibilities of Ile a la Crosse Lake, Sask., the party consisting of myself and two men left Winnipeg on January 3rd. for Big River, Sask, via Prince Albert. Were delayed two days at Big River and left there on January 9th, with two teams of horses supplied by the Big River Consolidated Fish Co.

The Winter road from Big River to Ile a la Crosse lake is very good. The portages between the lakes are low and level and teams are able to haul up to sixty hundred pounds. The road crosses Stoney (De Laronde) and Dore Lakes and comes out at La Plonge Mission on the Beaver River, 25 miles south of Ile a la Crosse Lake and follows the river from here to the lake. The freighters get loads both ways. Supplies for the Missions and Trading Co's going in and fish for the return trip. The hauling rate on this account is very reasonable for the distance, \$2.50 per cwt to Ile a la Crosse Lake and \$2.75 per cwt to Wapichewanak (Shagwena) Lake which is about 200 miles from Big River.

From information received on the way in, that the Ile a la Crosse Mission and Village were built on very low ground, made a side trip to the village before going on and took some elevations of some more important buildings above the present water level.

1. Priest's House. Very old 2 storey frame building. Value \$15,000 10 ft. above lake.
2. Mission School. New 3 storey frame building. Value \$40,000 11 ft. above lake.
3. Hospital. New 2 storey frame building. Value \$100,000 12.2 ft. above lake.
4. Church. Old frame building. Value \$10,000 Floor 9 ft. above lake.

(These are estimated values)

There are about 20 other buildings in the village, mostly of log structure, consisting of a Government Telegraph Station connecting with Big River Govt. Radio and Air Depot (Forest Fire Protection). The other buildings are mostly small houses and stables and are all from 9 to 12 feet above present water level of the lake. During high water, the village, which is built on a long narrow point, is cut into a series of small islands. In 1902 the water came into the Church (a few inches above floor level) and during the year 1920 - 21 and 22 the water was almost as high. The present water level of the lake is 15 inches higher than 1928 and the depth of snow on Jan. 20th was from 14 to 16 inches. The shores are low and flat and owing to the absence of any rocks showing above water level, it was impossible to get any definite high water marks and there were no records available at any of the Govt. Stations or Mission.

There is a water route to the lakes in summer from Big River without any portages and the general rate to points on the lakes is \$3.00 per cwt. On account of the Grand Rapids on the Beaver River, which are about 6 miles long, it is the custom (for any large tonnage) to build barges at Big River and dismantle them at their destination, although fair sized freighting canoes can be poled up the rapids. This route from Big River is down Cowan Lake, through Crooked (Cowan) River and in to the Beaver at the outlet of

From Ile a la Crosse Mission, we travelled about 40 miles by the Lake to Wapichevanak, the outlet into the Churchill River. The river is about a mile long here with a drop of 5.3 feet into Wapichevanak (Shagvenav) Measured the river on Jan. 29th and got a flow of 3814 c.f.s. and a mean velocity of 2.42. The inflow to the lakes during high water is apparently much greater than the outflow, as the lake level rises very rapidly during a wet period. The priest in charge of the mission informed me that they had an engineer look into the possibility of widening the channel at Wapichevanak in order to get away from the danger of floods.

TIMBER.

There is practically no timber in Ile a la Crosse Lake. The growth along the river is mostly poplar up to 6" diameter and a small percentage of 8" Jackpine. There is, however, sufficient timber in Wapichevanak Lake to build a crib dam. The longest haul would be about 6 miles from river. In summer it could be towed to the mouth of the river and skidded with horses to the dam location. They have a small sawmill and planer at the La Plonge Mission on Beaver River, but owing to the scarcity of timber there now, and the long haul from what is available to the mill, manufactured lumber could be hauled in from Big River at less cost. I

It would be possible to raise Ile a la Crosse, Churchill, Frobisher and Peter Pond Lakes, which are the same water level, 5 feet without doing any property damage outside of flooding some 400 acres of wild hay on the Beaver River. The foundation for a storage dam would have to be examined in the summer as the bottom of the river is covered with boulders and the banks are very hard, compact gravel and large boulders. The only location for a dam was about 1400 feet down river from Ile a la Crosse Lake. The Churchill from the outlet of Wapichevanak Lake is very wide with low shore line. This condition holds for a long distance down river from any information that could be got.

Established a water gauge at the outlet of Ile a la Crosse Lake, to be read by David Adams of the Hudson's Bay Co, and one at the mouth of the Beaver River to be read by Richard Kirby. These readings to be taken weekly and to be sent in the end of each month to Island Falls. Salary to be \$5.00 per month.

On January 30th. the Wapichevanak gauge was 42" to water level and the Kirby gauge 47 1/2".

With regard to the Mission buildings being built on such low ground when I was there the entire water works system was frozen up in the new hospital and the basement flooded. The priest in charge of the Mission informed me that he was very sorry the buildings were not on higher ground. There is a good building site on an Island about a half a mile away which is twenty-five to thirty feet above present water level with an area of about 400 acres.

A. R. McDougall.

ARMcD/F